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New record of the bothid flounder *Parabothus taiwanensis* (Bothidae, Pleuronectiformes) from the southern Pacific Ocean (Vanuatu Archipelago) with description of a new diagnostic character

by

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Résumé. – Nouveau signalement de *Parabothus taiwanensis* (Bothidae, Pleuronectiformes) dans l'océan Pacifique sud (archipel des Vanuatu) et description d'un nouveau caractère diagnostique.

La découverte d'une espèce rare de Bothidae, *Parabothus taiwanensis* dans l'archipel des Vanuatu, initialement répertoriée dans l'est de la mer de Chine, est présentée. La zone de répartition de cette espèce s'est donc considérablement élargie vers le sud-est, en mer de Corail, à des profondeurs de 250 m. Une description illustrée des spécimens est présentée, ainsi qu'un nouveau caractère diagnostique pour l'espèce : présence de perforations à la base de la membrane des nageoires dorsale et anale. L'examen comparatif de 44 spécimens types de 22 espèces différentes, parmi les sept genres de Bothidae, a permis de mettre en évidence la présence de ces perforations pour neuf espèces parmi les 22. Ce caractère est donc un critère précieux à utiliser pour la diagnose des espèces de Bothidae.

Key words. – Bothidae – *Parabothus taiwanensis* – South Pacific Ocean – Vanuatu Archipelago – New record.

The bothid flounder family Bothidae contains 20 genus and 166 species. Most of the known species have wide distributions, others are restricted to specific zones and depth ranges. Fourteen bothid specimens captured near Vanuatu Archipelago were confirmed to be *Parabothus taiwanensis* (Pleuronectiformes; Bothidae), a rare species described before from only five specimens from the coasts of Taiwan and recorded only from the East China Sea (Amaoka and Shen, 1993; Yamada *et al.*, 2007). The present note provides a description of these specimens with considerable range extension for this species and a new diagnostic character.

MATERIAL AND METHODS

Measurements follow Hubbs and Lagler (1958). X-rays were used for the osteological examination and vertebral counts. Institution abbreviations follow Leviton *et al.* (1985). Length of the pelvic-fin base was measured from the base of the first ray to that of the sixth ray (Amaoka and Shen, 1993). Detailed description of the holotype and paratypes was used as comparative material (Tab. I). The newly revealed diagnostic character was studied in 22 bothid

species in order to trace its distribution among bothid genera close to *Parabothus*.

Specimens examined

Parabothus taiwanensis. - MNHN 2012-0634, 8 spms (73.1-108.2 mm SL), station at 64,15°66'S-167°032'E, depth 249-252 m, West of Malo Island, 4 Oct. 2006; MNHN 2012-0633, 81.0 mm SL, station at 13,15°46'S-167°26'E, Aese Island, depth 146-153 m, 19 Sep. 2006; MNHN 2012-0638, 5 spms (65.3-89.4 mm SL), station at 5,15°67'S-167°06'E, depth 114-132 m, North-West of Malo Island, 15 Sep. 2006. All specimens were collected during Santo 06 cruise of R/V *Alis* by beam trawl in Vanuatu Archipelago.

Comparative material

Parabothus taiwanensis, HUMZ 114127 (holotype, 119.8 mm SL). *Arnoglossus nigrifrons*, MNHN 1995-1168 (holotype, 119.8 mm SL). *A. septemventralis*, MNHN 1995-1170 (paratype, 85.1 mm SL). *Bothus guibei*, MNHN 1964-0438, 1964-0439 (4 spms, holotype and paratypes, 170.2-215.4 mm SL). *B. podas*, MNHN B-3003 (2 spms, 161.3 and 146.1 mm SL). *Grammatobothus krempfi*, MNHN 1947-0019 (holotype, 147.0 mm SL). *Engyprosopon bellonaensis*, MNHN 1993-0143 (paratype, 54.6 mm SL). *E. longipterum*, MNHN 1993-0090 (2 spms, paratypes, 74.5 mm SL). *E. rostratum*, MNHN 1993-0148, 1993-72 (3 spms, paratypes, 62.2-72.3 mm SL). *Monolene microstoma*, MNHN 1938-0011 (syntype, 132.2 mm SL). *Parabothus amaokai*, ZIN 46157 (holotype, 110.2 mm SL). *P. budkeri*, MNHN 1942-0031 (holotype, 81.1 mm SL); MNHN 1942-0032 and 0033 (2 spms, paratypes, 118.3 and 50.5 mm SL, respectively). *P. chlorospilus*, USNM 51647 (holotype, 150.3 mm SL). *P. coarctatus*, USNM 51602 (holotype, 137.5 mm SL). *P. filipes*, MNHN 1994-0360 (holotype, 77.8 mm SL); MNHN 1994-0359, 0365 and 0366 (3 spms, paratypes, 79.4, 61 and 71.9 mm SL, respectively). *P. kiensis*, ZUMT 8313 (holotype, 170.8 mm SL). *P. malhensis*, BMNH 1908.3.23.147 (holotype, 149.0 mm SL). *Tosarhombus brevis*, MNHN 1994-0347 (holotype, 131.8 mm SL); MNHN 1994-0343, 0345, 0348 and 0349 (4 spms, paratypes, 88.2, 54.9, 109.9 and 82.4 mm SL, respectively). *T. nielseni*, HUMZ 73467 (holotype, 110.2 mm SL). *T. neocaldonicus*, MNHN 1988-0686 (holotype, 163.9 mm SL); MNHN 1988-0867 and 1999-2052 (2 spms, paratypes, 109.2 and 168.1 mm SL, respectively). *T. longimanus*, MNHN 1994-0330 to 1994-0333 and

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Figure 1. - *Parabothus taiwanensis* MNHN 2012-0634 (92.3 mm SL).

Table I. - Counts and measurements (expressed as percent of SL) for *Parabothus taiwanensis*. o: ocular side; b: blind side.

	Present study Santo Island	Amaoka and Shen, 1993 Taiwan
Dorsal fin rays	96-107	100-107
Anal fin rays	76-83	78-84
Pectoral fin rays (o)	11-13	12-13
Pectoral fin rays (b)	8-11	9-11
Scales in lateral line	60-69	61-62
Gill rakers	0 + 6-8	0 + 7-8
Vertebrae	10 + 28-29 (28.9)	10 + 28-29
SL (mm)	65.3-108.2	80.4-148.5
Head length	25.1-28.8(26.8)	24.4-25.8(25.2)
Body depth	39.7-46.3(43.4)	40.4-45.5 (43.7)
Snout length	5.6-8.3(7.0)	5.1-5.9 (5.5)
Upper eye	5.6-8.3(7.0)	7.1-7.5 (7.3)
Lower eye	5.6-7.6(6.9)	6.9-7.5 (7.1)
Interorbital width	2.5-4.8(3.5)	2.6-4.4 (3.8)
Upper jaw (o)	7.4-11.3(9.1)	8.1-8.7 (8.4)
Upper jaw (b)	8.4-11.3(9.6)	8.6-8.8 (8.7)
Lower jaw (o)	11.2-13.8(12.5)	10.9-11.8 (11.4)
Lower jaw (b)	11.2-14.2(13.1)	11.2-12.9 (12.3)
Caudal peduncle depth	9.2-11.3(10.4)	10.1-11.0 (10.6)
Pectoral fin (o)	12.0-17.1(14.9)	15.2-16.6 (15.9)
Pectoral fin (b)	7.6-11.0(8.5)	7.7-9.5 (8.5)
Pelvic fin (o)	8.4-10.4(9.4)	8.2-10.1 (9.1)
Pelvic fin (b)	7.7-10.5(9.1)	7.7-8.8 (8.4)
Pelvic fin base (o)	7.6-10.8(8.9)	8.1-9.5 (8.5)
Pelvic fin base (b)	3.3-6.3(4.9)	3.4-4.5 (3.9)
Longest dorsal fin ray	9.3-12.3(10.7)	10.6-12.6 (11.5)
Longest anal fin ray	9.0-12.4(10.8)	11.2-12.8 (12.0)

1994-0335 to 1994-0342 (5 spms, paratypes, 69.3-139.7 mm SL). *T. smithi*, ZMUC P853157 (holotype, 153.5 mm SL).

RESULTS

Identification

Parabothus taiwanensis is distinguished from all other Bothinæ species by the following combination of characters: narrow interorbital width in even male and rather narrower body, small

number of scales in lateral line, knob on snout tip and mandibular symphysis in males, biserial teeth on upper jaw; pale purplish body after removal of scales; moderate concave interorbital width and moderate body depth (Amaoka and Shen, 1993). Our specimens have these peculiarities (Fig. 1). Counts and measurements are given in table I. They are almost identical to those described by Amaoka and Shen (1993). There is small difference in snout length: mean 7.0% of head length in our specimens versus 5.5% in the original description.

Description of a new diagnostic character

In all studied specimens of *P. taiwanensis*, as well as in the holotype, a new diagnostic character for this species was revealed: the bases of the dorsal and anal fin membranes are perforated (Fig. 2).

Sexual dimorphism

The holotype (148.5 mm SL) and two large paratypes (125.1 and 137.1 mm SL) of *P. taiwanensis* have large rostral and mandibular knobs, and a wide interorbital region. They were therefore considered as males (Amaoka and Shen, 1993). Authors treated the remaining paratype as too small (80.4 mm SL) for sex determination and supposed that females of *P. taiwanensis* have interorbital width narrower and no mandibular or rostral knobs. Among 14 not adult specimens (65.3-108.2 mm SL) studied in the present work sex was not determined and differences in these characters were not revealed.

Distribution

Parabothus taiwanensis was only previously found in the East China Sea near southwestern and northeastern coasts of Taiwan (Amaoka and Shen, 1993) and the western waters of Okinawa Island (Yamada *et al.*, 2007). Its distribution can now be extended to several thousand kilometres to the south-east along the Vanuatu Archipelago coasts, Coral Sea, with depth to 250 m (Fig. 3).

DISCUSSION

The specimens clearly belong to *Parabothus* in having narrow interorbital width in even males and rather narrower body. They were identified as *Parabothus taiwanensis* in having a combination of characters unique to that species among the subfamily Bothinæ: small number of scales in lateral line (61-62); knob on snout tip and mandibular symphysis in males (moderate in our specimens); biserial teeth on upper jaw; pale purplish body after removal of scales; moderate concave interorbital width and moderate body depth (Amaoka and Shen, 1993). We consider the longer snout of our specimens as geographic or individual variation, rather than

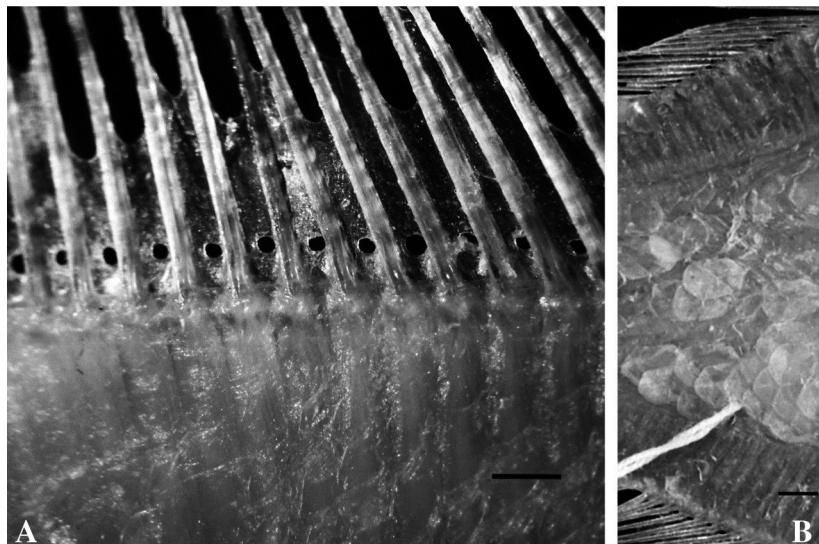


Figure 2. - Perforated membrane of *Parabothus taiwanensis* median fins (blind side). **A:** Dorsal fin. MNHN 2012-0634. Scale bar = 1 mm; **B:** Dorsal and anal fins. Holotype HUMZ 114127. Scale bar = 5 mm.

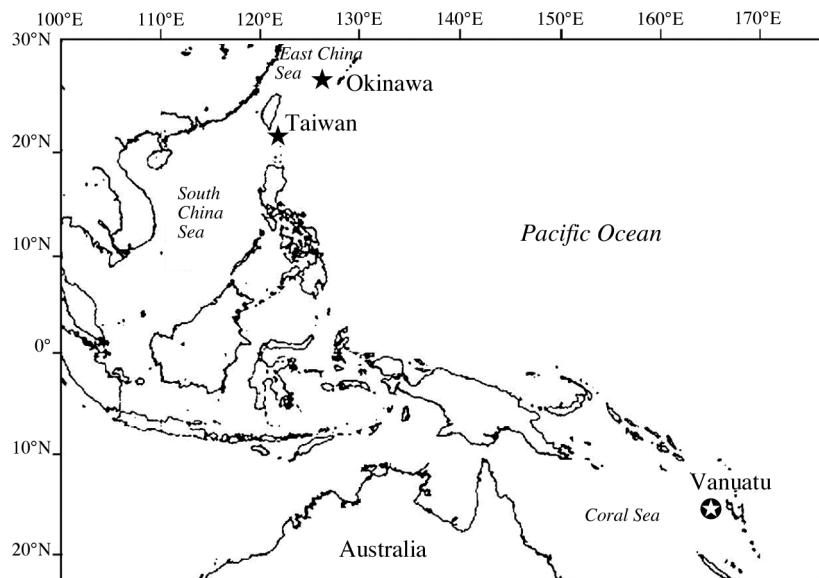


Figure 3. - Map with the locations of *Parabothus taiwanensis* records. ★ Records near Taiwan (Amaoka, Shen, 1993) and Okinawa (Yamada *et al.*, 2007); ● New record in Vanuatu Archipelago.

specific characters, taking into account the larger number of studied specimens in this paper (13 versus five in the original description).

Parabothus taiwanensis is known now from East China Sea near Taiwan and Okinawa Island, Japan and the Vanuatu Archipelago, Coral Sea, and Western Central Pacific Ocean.

The new diagnostic character, perforations of the bases of median fin membranes, can be added to the diagnosis of *Parabothus taiwanensis*. Although this character is rarely present in teleosts, there are some examples of its use as, e.g. in diagnosis of family Diretmidae (Moore, 2002) or in descriptions of monacanthid species (Hutchins, 2002). Among flatfishes it was mentioned and figured in *Asterorhombus osculus* (Amaoka and Arai, 1998). In the present study, the examination of 44 type specimens of 22 species

in seven bothid genera revealed perforations at the base of the dorsal and anal fin membranes in *Parabothus chlorospilus*, *P. kiensis*, *P. taiwanensis*, and *Arnoglossus nigrifrons* and in all five studied species of the genus *Tosarhombus*. This character is not mentioned in the original descriptions of these species (Gilbert, 1905; Tanaka, 1918; Nielsen, 1964; Amaoka and Rivaton, 1991; Amaoka and Shen, 1993; Amaoka *et al.*, 1997; Amaoka and Mihara, 2000) as well as in reviews on flatfishes (Norman, 1934; Amaoka, 1969). According to our observations, the medial fin membranes are not perforated in the other 13 species studied (*Arnoglossus septemventralis*, *Bothus guibei*, *B. podas*, *Engyprosopon belonaensis*, *E. longipterum*, *E. rostratum*, *Grammatobothus krempfi*, *Monolene microstoma*, *Parabothus amaokai*, *P. budkeri*, *P. filipes*, and *P. malhensis*). The poor preservation of the fin of the holotype of *Parabothus coarctatus* does not allow to determine this character with confidence. Our preliminary data obtained in some bothid species, e.g. *Crossorhombus azureus*, indicated that the membrane bases are partly perforated, i.e. holes are present between some rays, while they are noticeable but closed by thin membrane between the other rays. Close relationships of bothid genera and uncertainty of generic placement of some species, including *P. taiwanensis*, do not allow yet evaluating the rank of this character. The perforated or not perforated base of fin membrane, a qualitative character with alternative states, is a valuable additional character to diagnoses of bothid species.

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